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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/816,770	03/26/2001	Tsuyoshi Kitahara	Q63724	4825

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EXAMINER	
NGUYEN, LAM S	
ART UNIT	**PAPER NUMBER**
2853	

DATE MAILED: 05/09/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/816,770	KITAHARA, TSUYOSHI	
	Examiner	Art Unit	
	LAM S. NGUYEN	2853	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 March 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *3-11,14,15,17-19,21-23,25,27 and 28* is/are allowed.

6)☒ Claim(s) *1,2,12,13,16,20 and 24* is/are rejected.

7)☒ Claim(s) *26* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *05 July 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

The indicated allowability of claims 1, 12, and 20 is withdrawn in view of the newly discovered reference(s) to Takahashi (US 6145949) and Sekiya et al. (US 5877786). Rejections based on the newly cited reference(s) follow.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 1 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites the limitation "serial drive signals" on line 22. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> **(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.**

1. Claims 1-2, 13, 16, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitahara et al. (EP0827838) in view of Barbehenn et al. (U.S. 5363134), Takahiro et al. (JP 11058704), and Takahashi (US 6145949).

Kitahara et al. discloses a method of jetting liquid droplets or a liquid jetting apparatus, comprising:

providing a liquid head (*FIG. 1, element 10*), including: a plurality of nozzle orifices (*FIG. 3, element 22A, and column 6, line 19-22*); a plurality of pressure generation chambers associated with the nozzle orifices (*FIG. 3, element 27, and column 7, line 38-39*); and a plurality of piezoelectric vibrators for respectively varying the volume of the associated pressure generation chamber to jet a liquid droplet from the associated nozzle orifice (*FIG. 3, element 17*);

Kitahara et al. does not disclose the providing ID data that provides the ID data for identifying the respective nozzle orifices.

Barbehenn et al. discloses a ID data storage for providing ID data for identifying respective nozzle orifices in a printhead (*column 3, line 43-53*).

Therefore, it would have been obvious for one having ordinary skill in the art at the time the invention was made to include the ID storage for providing the ID data of the respective nozzle orifices as disclosed by Barbehenn et al. into the printing apparatus disclosed by Kitahara et al. The motivation for doing so would have been to increase the capability of controlling the ejecting of proper ink volume, the ink drop velocity, and various other manufacturing tolerances or defects for driving an array of nozzle orifices as taught by Barbehenn et al. (*column 2, line 2-8*).

In addition, Kitahara et al. and Barbehenn et al. do not disclose the providing of a reference drive signal which is applied to the piezoelectric vibrator such that a reference liquid droplet having a designated amount is jetted from the nozzle orifice, applying the reference drive

signal to the respective piezoelectric vibrators to jet liquid droplet from the nozzle orifices; measuring amounts of the respective liquid droplets jetted by the reference drive signal, identifying a difference between the designated amount and the measured amount of each liquid droplet; providing correction data for reducing the difference, associating the correction data with the respective nozzle orifices identified by the ID data, storing the associated correction data, providing a plurality of drive signals for driving the piezoelectric vibrators to jet liquid droplets from the nozzles, selecting at least one drive signal from the plurality of drive signals to adjust a displacement behavior of a piezoelectric vibrator associated with the identified nozzle orifice, based on the associated correction data when the identified nozzle orifice receives print data (**Referring to claims 13, 16**), and applying the selected drive signal to the piezoelectric vibrators, wherein the at least one drive signal within a single jetting cycle of the jetting head is selected in the selecting step and wherein the plurality of drive signals respectively have different liquid jetting energy from each other (**Referring to claim 2**).

Takahiro et al. discloses a process used in an image forming apparatus comprising the steps of providing a reference drive signal to instruct the piezoelectric vibrator to jet a reference liquid droplet having a designated amount from the nozzle orifice (*paragraph [0023]: a corresponding drive waveform is given to each ink discharge means to discharge an ink quantity that is setup beforehand*), applying the reference drive signal to the respective piezoelectric vibrators to jet liquid droplet from the nozzle orifices, measuring amounts of the respective liquid droplets jetted by the reference drive signal (*paragraph [0023]: the drive waveform is applied to the ink discharge means 1-1 to 1-N and the amount of ink ejected out from each nozzle is measured*); identifying a difference between the designated amount and the measured amount

of each liquid droplet (*paragraph [0023]: comparing the reference value of the ink discharge quantity set up beforehand to the measured ink discharge value*), providing correction data for reducing the difference so that the designated amount is jetted from the nozzle orifice (*paragraph [0023]: an error with the amount of ink ejected from each nozzle is computed and the variation amendment is adjusted so the desired amount of ink is ejected from each nozzle*), associating the correction data with the respective nozzle orifices identified by the ID data (*paragraph [0023]: the amount of ink ejected is measured and used to compute the error for each nozzle*), storing the associated correction data (*paragraph [0023]: the variation amendment table is adjusted*), providing a plurality of drive signals for driving the piezoelectric vibrators to jet liquid droplets from the nozzles *(FIG. 3, waveforms 1-M*), selecting at least one drive signal from the plurality of drive signals to adjust a displacement behavior of a piezoelectric vibrator associated with the identified nozzle orifice, based on the associated correction data when the identified nozzle orifice receives print data, and applying the selected drive signal to the piezoelectric vibrators (*Abstract and FIG. 1: the selectors 3-1 to 3-N, based on the correction data of the ink discharge amount, select a voltage waveform from a plurality of waveforms generated by the generators 2-1 to 2-N to control the liquid ejection of the discharge elements 1-1 to 1-N*), wherein the at least one drive signal within a single jetting cycle of the jetting head is selected in the selecting step and wherein the plurality of drive signals respectively have different liquid jetting energy from each other (*FIG. 3: Each waveform 1-N has different jetting energy and is a single waveform in a jetting cycle to cause an ejection of a droplet having an amount different from the others*).

Therefore, it would have been obvious for one having ordinary skill in the art at the time the invention was made to modify the process used in the jetting liquid droplets apparatus disclosed by Kitahara et al. in view of Barbehenn et al. such that including the steps of providing the reference drive signal to the actuator to jet a designated amount of liquid, measuring amounts of the jetted liquid droplets, identifying a difference between the designated amount and the measured amount of each liquid droplet, providing correction data for reducing the difference, and adjusting a displacement behavior of the piezoelectric vibrator based on the corrected data as disclosed by Takahiro et al. into The motivation of doing so is to control the variation in the ink discharge quantity from each nozzle in order to obtain a record image without concentration unevenness or banding as taught by Takahiro et al. (*paragraph [0024]*).

Kitahara et al. and Takahiro et al. also do not disclose wherein the drive signals in the plurality of drive signals are serial, wherein the selected serial drive signals are applied at different intervals within the single jetting cycle (**Referring to claim 24**).

Takahashi discloses an ink jet recorder including a recording head having piezoelectric vibrators for ejecting ink when applied by a serial driving signal elected from a plurality of serial driving signals (*FIG. 5A-C*). In addition, because each serial drive signals having different total amount of duty time (e.g. the first drive signal is 3.75T, the second drive signal is 4.35T, the third drive signal is 5.61T), each is applied at different intervals within a single jetting cycle.

Therefore, it would have been obvious for one having ordinary skill in the art at the time invention was made to modify the driving signals disclosed by Kitahara et al. and Takahiro et al. being serial as disclosed by Takahashi. The motivation for doing so would have been to be able

to eject multiple ink drops in succession which be united to create different volume of ink dots as taught by Takahashi (*column 6, lines 44-50*).

2. Claims 12 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitahara et al. (EP0827838) in view of Barbehenn et al. (U.S. 5363134), Takahiro et al. (JP 11058704), and Sekiya et al. (US 5877786).

Kitahara et al. discloses a method of jetting liquid droplets or a liquid jetting apparatus, comprising:

providing a liquid head (*FIG. 1, element 10*), including: a plurality of nozzle orifices (*FIG. 3, element 22A, and column 6, line 19-22*); a plurality of pressure generation chambers associated with the nozzle orifices (*FIG. 3, element 27, and column 7, line 38-39*); and a plurality of piezoelectric vibrators for respectively varying the volume of the associated pressure generation chamber to jet a liquid droplet from the associated nozzle orifice (*FIG. 3, element 17*);

Kitahara et al. does not disclose the providing ID data that provides the ID data for identifying the respective nozzle orifices.

Barbehenn et al. discloses a ID data storage for providing ID data for identifying respective nozzle orifices in a printhead (*column 3, line 43-53*).

Therefore, it would have been obvious for one having ordinary skill in the art at the time the invention was made to include the ID storage for providing the ID data of the respective nozzle orifices as disclosed by Barbehenn et al. into the printing apparatus disclosed by Kitahara et al. The motivation for doing so would have been to increase the capability of controlling the ejecting of proper ink volume, the ink drop velocity, and various other manufacturing tolerances

or defects for driving an array of nozzle orifices as taught by Barbehenn et al. (*column 2, line 2-8*).

In addition, Kitahara et al. and Barbehenn et al. do not disclose the providing of a reference drive signal which is applied to the piezoelectric vibrator such that a reference liquid droplet having a designated amount is jetted from the nozzle orifice, applying the reference drive signal to the respective piezoelectric vibrators to jet liquid droplet from the nozzle orifices; measuring amounts of the respective liquid droplets jetted by the reference drive signal, identifying a difference between the designated amount and the measured amount of each liquid droplet; providing correction data for reducing the difference, associating the correction data with the respective nozzle orifices identified by the ID data, storing the associated correction data, providing a plurality of drive signals for driving the piezoelectric vibrators to jet liquid droplets from the nozzles, selecting at least one drive signal from the plurality of drive signals to adjust a displacement behavior of a piezoelectric vibrator associated with the identified nozzle orifice, based on the associated correction data when the identified nozzle orifice receives print data, and applying the selected drive signal to the piezoelectric vibrators, wherein the at least one drive signal within a single jetting cycle of the jetting head is selected in the selecting step and wherein the plurality of drive signals respectively have different liquid jetting energy from each other.

Takahiro et al. discloses a process used in an image forming apparatus comprising the steps of providing a reference drive signal to instruct the piezoelectric vibrator to jet a reference liquid droplet having a designated amount from the nozzle orifice (*paragraph [0023]: a corresponding drive waveform is given to each ink discharge means to discharge an ink quantity*

that is setup beforehand), applying the reference drive signal to the respective piezoelectric vibrators to jet liquid droplet from the nozzle orifices, measuring amounts of the respective liquid droplets jetted by the reference drive signal (*paragraph [0023]: the drive waveform is applied to the ink discharge means 1-1 to 1-N and the amount of ink ejected out from each nozzle is measured*); identifying a difference between the designated amount and the measured amount of each liquid droplet (*paragraph [0023]: comparing the reference value of the ink discharge quantity set up beforehand to the measured ink discharge value*), providing correction data for reducing the difference so that the designated amount is jetted from the nozzle orifice (*paragraph [0023]: an error with the amount of ink ejected from each nozzle is computed and the variation amendment is adjusted so the desired amount of ink is ejected from each nozzle*), associating the correction data with the respective nozzle orifices identified by the ID data (*paragraph [0023]: the amount of ink ejected is measured and used to compute the error for each nozzle*), storing the associated correction data (*paragraph [0023]: the variation amendment table is adjusted*), providing a plurality of drive signals for driving the piezoelectric vibrators to jet liquid droplets from the nozzles *(FIG. 3, waveforms 1-M*), selecting at least one drive signal from the plurality of drive signals to adjust a displacement behavior of a piezoelectric vibrator associated with the identified nozzle orifice, based on the associated correction data when the identified nozzle orifice receives print data, and applying the selected drive signal to the piezoelectric vibrators (*Abstract and FIG. 1: the selectors 3-1 to 3-N, based on the correction data of the ink discharge amount, select a voltage waveform from a plurality of waveforms generated by the generators 2-1 to 2-N to control the liquid ejection of the discharge elements 1-1 to 1-N*), wherein the at least one drive signal within a single jetting cycle of the jetting head is

selected in the selecting step and wherein the plurality of drive signals respectively have different liquid jetting energy from each other (*FIG. 3: Each waveform 1-N has different jetting energy and is a single waveform in a jetting cycle to cause an ejection of a droplet having an amount different from the others*).

Therefore, it would have been obvious for one having ordinary skill in the art at the time the invention was made to modify the process used in the jetting liquid droplets apparatus disclosed by Kitahara et al. in view of Barbehenn et al. such that including the steps of providing the reference drive signal to the actuator to jet a designated amount of liquid, measuring amounts of the jetted liquid droplets, identifying a difference between the designated amount and the measured amount of each liquid droplet, providing correction data for reducing the difference, and adjusting a displacement behavior of the piezoelectric vibrator based on the corrected data as disclosed by Takahiro et al. into The motivation of doing so is to control the variation in the ink discharge quantity from each nozzle in order to obtain a record image without concentration unevenness or banding as taught by Takahiro et al. (*paragraph [0024]*).

Moreover, Kitahara et al. in view of Barbehenn et al. and Takahiro et al. does not disclose wherein volume differences among the liquid droplets ejected by the respective drive signals can be divided by a volume of a liquid droplet which is the minimum volume jetted by one single drive signal.

Sekiya et al. discloses an ink jet recording method for ejecting plurality of ink droplets by a single drive signal or a plurality of serial drive signals (*FIG. 3*), wherein volume differences among the liquid droplets ejected by the respective drive signals can be divided by a volume of a liquid droplet which is the minimum volume jetted by one single drive signal (*FIG. 3: Because*

the volume differences among the ink dots 26 is the different number of ink droplets 24 constituting the dots, the volume difference is dividable by the volume of one droplet 24 ejected by a single drive signal (a)).

Therefore, it would have been obvious for one having ordinary skill in the art at the time invention was made to modify the driving signals disclosed by Kitahara et al. in view of Barbehenn et al. and Takahiro et al. such that the volume differences among the liquid droplets ejected by the respective drive signals can be divided by a volume of a liquid droplet which is the minimum volume jetted by one single drive signal as disclosed by Sekiiya et al. The motivation for doing so would have been to control the dot size in accordance with image density so that gray scale recording of images can be performed as taught by Sekiya et al. (*column 2, lines 35-40*).

Allowable Subject Matter

3. Claims 3-11, 14-15, 17-19, 21-23, 25, and 27-28 are allowed. Claim 26 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The reasons for allowance of claims 6-11, 15, 18-19, 22-23, 25, 27-28 were indicated in the previous office action.

Referring to claim 3: The primary reasons for the indication of the allowability of the claim is the inclusions therein, in combination as currently claimed, of the limitation that selecting M drive signals from the N serial drive signals based on the associated correction data, M being an integer which is equal to or less than N, where $N > 1$ is neither disclosed nor taught by the cited prior art of record, alone or in combination.

Referring to claim 26: The primary reasons for the indication of the allowability of the claim is the inclusions therein, in combination as currently claimed, of the limitation that wherein the intervals are determined such that a phase of residual vibration of a meniscus of the liquid in the nozzle orifice is adjusted due to jetting by a preceding drive signals is neither disclosed nor taught by the cited prior art of record, alone or in combination

Claims 4-5, 14, 17, 21 are allowed because they depend directly/indirectly on claim 3.

Response to Arguments

Applicant's arguments filed 03/09/05 as regarding to claim 3 have been found persuasive. As a result, claim 3 is allowed in light of the applicants' arguments.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to LAM S NGUYEN whose telephone number is (571)272-2151. The examiner can normally be reached on 7:00AM - 3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, STEPHEN D MEIER can be reached on (571)272-2149. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

LN
05/04/05

Hai Pham

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PRIMARY EXAMINER